VII. Looking to the Future

Planning for cleanup at the T Plant reprocessing "canyon" at Hanford. Engineers work on methods for decontaminating and eventually dismantling the world's oldest plutonium-separation plant. In the meantime, the facilities at the T Plant are being used to decontaminate equipment with high-activity contamination. *Hanford Site, Washington. July 11, 1994.*

Hundreds of thousands of people–machinists, physicists, engineers, cooks, truck drivers, secretaries, policymakers–worked in the nuclear weapons complex. From the beginnings of the Manhattan Project to the end of the Cold War, they accomplished extraordinary and unprecedented feats. As a nation, we are indebted to their ingenuity, enterprise, and plain hard work.

The nation is also indebted to those who brought to light the environmental, health, and safety problems throughout the complex–from "whistleblowers" at facilities to citizens living in the shadow of nuclear weapons sites to oversight committees in the Congress. The democratic values and rights championed by these individuals demonstrate exactly what the nation fought for during the Cold War. These rights and values continue to be vital to solving many of the problems and issues highlighted in this book. Only by building on such values can the Department of Energy make the kind of progress needed to get the job done properly.

Providing for Broad-Based Debate and Participation

The Department has demonstrated the value of linking its technical capabilities with democratic values. As major environmental projects began, public participation contributed much to the Department's efforts in stabilizing uranium-mill tailings and cleaning up numerous sites used during the Manhattan Project. The participation of state and local governments, regulatory agencies, Native American Tribes, and others also has been instrumental in writing environmental compliance agreements to provide meaningful and practical roadmaps for cleanup.

The Energy Department is committed to getting results with the tools available and to finding new technical solutions through research and development. It has dedicated significant resources to solving such problems as stabilizing high-level radioactive waste and removing or isolating soil and ground-water contamination.

Boxes containing low-level radioactive waste lie in a shallow land burial trench at the Savannah River Site. New methods for disposal of low-level waste are being developed by the Department. *Savannah River Site, South Carolina. January 7, 1994.*

In many cases, the most vexing problems cannot be addressed solely by science but will require a broad-based and informed public debate.

Strategy Before Action

The Department of Energy is evaluating how it will clean up its defense and nondefense facilities. This effort is based on its own recent experience and on lessons from the Environmental Protection Agency's Superfund program for hazardous waste. Both of these programs have made evident certain painful realities:

- Today's remediation technologies are often inadequate for fully solving many contamination problems, while innovative methods often encounter unexpected problems.
- Insufficient information is available for fully characterizing human and environmental risks.
- Few broadly accepted standards exist for determining "how clean is clean."
- The requirements for cleanup work often exceed available resources.

In light of these realities, the Department is trying to stabilize sites quickly, with a minimum of paper study, while investing in the development of more effective technologies. A better understanding of risks through the work of the new Environmental Management Office of Integrated Risk Management will help provide information to guide the program.

What are we doing today that will prompt another generation to say, "How could the scientists, policymakers, and environmental specialists not have seen the consequences of their actions?"

Current Situation: Where and How to Treat Stored Waste

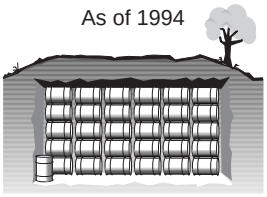
Stored Waste

Total amount stored: 0.75 million cubic meters.
Most will require treatment prior to disposal.

- approx. 380,000 cubic meters — High-level waste
- approx. 75,000 cubic meters — Transuranic waste
- approx. 160,000 cubic meters — "Mixed" hazardous and radioactive low level waste
- approx. 130,000 cubic meters — Low-level waste

Buried Waste

As of 1994

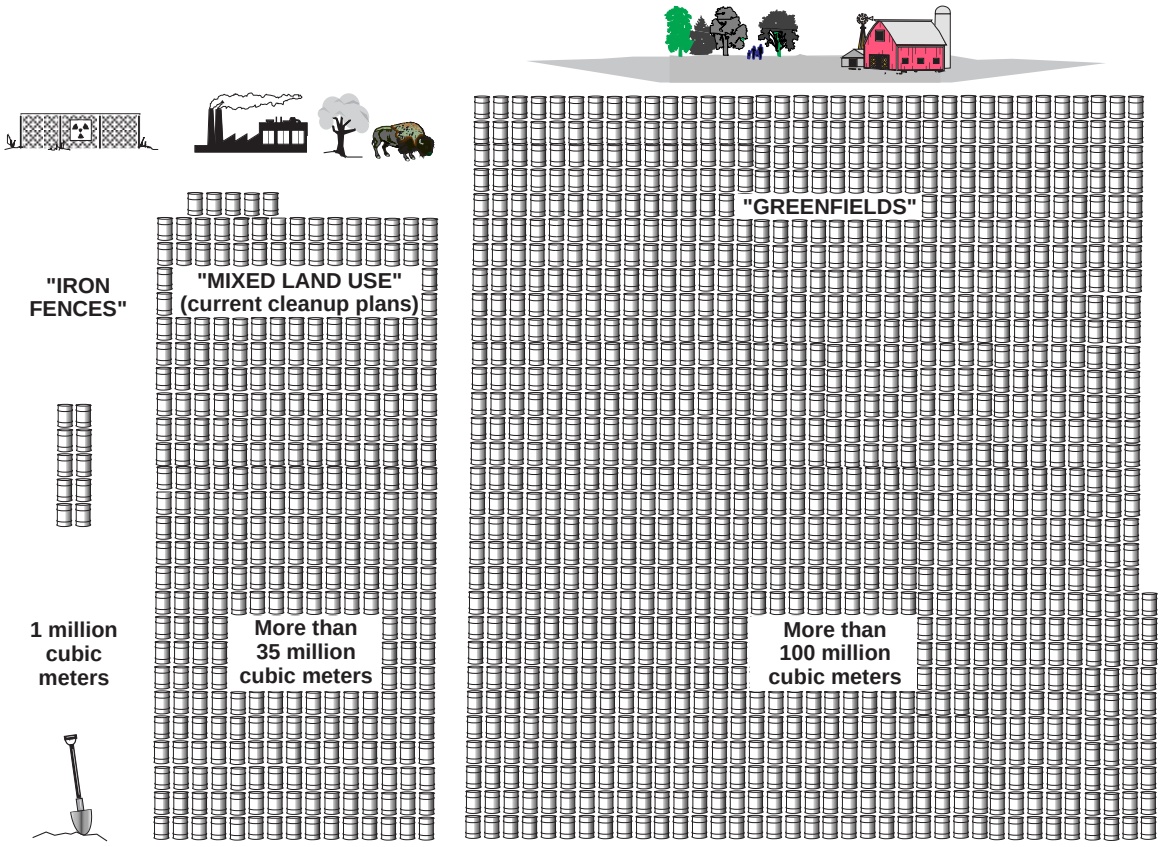


3.1 million cubic meters

Future Dilemma: More Waste, or Less Land Use ?

How much waste will be produced by environmental restoration work?

Three scenarios:



- Each drum represents 100,000 cubic meters of waste
- Based on current estimates from data collected for the 1995 Baseline Environmental Management Report (BEMR).

Dealing with the environmental legacy of the Cold War poses both technical and policy challenges. One imminent challenge is preparing the backlog of stored waste for disposal. The volume of waste currently in storage is nearly a third of the total amount of waste the Department has previously buried, virtually all of which was untreated before disposal. Most of this stored waste will require treatment prior to disposal. Consequently, the Department is undertaking an unprecedented campaign to design, site, construct, and operate facilities to comply with environmental laws. This endeavor will require not only developing new treatment technologies, but also working with regulators and other stakeholders to decide where and which treatment and disposal technologies should be used.

In the near future, difficult decisions will need to be made about what course of action the environmental restoration program should take. One of the principal issues will be: What will the land be used for after environmental restoration? Will it be sufficiently cleaned up for any purpose, including for a farm family that eats the crops grown on the land? If so, a large amount of contaminated soil may need to be dug up and many buildings will need to be dismantled, producing a large amount of waste requiring treatment or disposal. Another option is to remove less soil and limit dismantlement, producing substantially less waste. If this scenario is chosen, the Department will have to impose restrictions on how the land will be used after cleanup. For example, only industrial, nonresidential uses may be allowed for the land, and from the outset, environmental restoration would be directed at future industrial development, rather than "green-field" uses. Unfortunately, the United States has little experience with long-term land-use restrictions, which have a tradition of local, rather then federal, control. Whatever option is chosen, it is clear that the amount of waste produced by environmental restoration will depend largely on assumptions about how the land can be safely used in the future.

The Integrated Demonstration Site at the Savannah River Site contains 150 monitoring wells, some quite shallow, some as deep as 200 feet. These wells are used to chart the migration of contaminants through the water table and through different levels of soil and rock. Included within this site is the world's first horizontal injection well used for environmental remediation. *A-M Area, Savannah River Site, South Carolina. January 6, 1994.*

Brian Looney – Environmental Scientist

When Brian Looney was in high school during the early 1970s, he wanted to fix things and solve problems. The first Earth Day in 1970 gave him a sense of the connections among organisms and ecosystems, and of the importance of "thinking globally while acting locally."

In 1983, after receiving his Ph.D. in environmental engineering from the University of Minnesota, Looney came to the Department of Energy's Savannah River Site in South Carolina, where he is a research environmental engineer. Six years later he was put in charge of a major research effort to apply new technologies to ground-water cleanup. Looney focused on removing from the soil and ground water "plumes" of toxic chemicals that have spread from their sources.

His team completed the research project in September 1994. As Looney puts it, "We didn't ask for more funding. My bias is toward finding efficient methods and getting there with cost-effective research."

A major success of Brian's team has been the first application of horizontal drilling to environmental cleanup. These methods had been developed by private industry to enhance oil extraction and to install pipelines and cables. Although horizontal drilling costs more per foot drilled, it allows a much larger proportion of each borehole to be in close contact with the contaminated zone. The seven test wells at the Savannah River Site have removed about 2,500 gallons of toxic contaminants from about 14 million cubic feet of contaminated soil. Now some of the techniques developed by Looney and his team have been adapted to industrial cleanup. About 100 horizontal wells have since been drilled for environmental projects nationwide.

Other innovations flowing from Looney's research could dramatically improve the effectiveness of environmental cleanup. For example, his team developed efficient methods for introducing nutrients like phosphorus and nitrogen into soils to encourage bacteria that can break down pollutants. They have also demonstrated that in many cases the standard laboratory tests for pollution provide unnecessary precision at excessive cost. Larger numbers of less costly "field screening" samples can often lead to a better understanding of the extent of contamination.

These examples illustrate some elements of Looney's environmental philosophy. First, he says, "Let's work with Mother Nature instead of against her whenever possible." This means considering all the side effects of every cleanup project. Looney also keeps his eye on the "life-cycle" costs of his work and strives to keep them as low as possible. This philosophy and a new breed of dedicated environmental professionals like Looney are key to solving environmental problems that are as exciting and challenging as the Manhattan Project.

Addressing the worst environmental concerns first is necessary but not sufficient. The Department must also begin to reduce the backlog of environmental, safety, and health problems inherited from the Cold War. The experience gained so far suggests the following strategy:

- Where appropriate, stabilize radioactive materials to avoid accidents, the spread of contamination, and immediate risks to the public.
- Develop a thorough understanding of complicated waste and contamination problems instead of rushing into solutions that might have unexpected side effects.
- Develop effective technologies for cost-effective environmental work. An investment in technology can pay off with methods that could apply to other national and global waste problems.
- Where feasible and appropriate, ensure that site cleanup is part of a long-term solution rather than a hasty fix. Long-term solutions must take into account worker safety, public health risks, ecological values, and cost.
- Prepare for future uses of large portions of the more than 3,000 square miles reserved for the U.S. nuclear weapons complex. Much of that land is not significantly contaminated and can be returned to some level of public, industrial, or commercial use. Other sites can be released to the public after remediation or with appropriate limits on their uses.

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A wastewater-treatment facility under construction at Hanford to treat low-level condensate from an evaporation process that reduces the volumes of high-level waste. Each of these three tanks has a capacity of 670,000 gallons. Because of the use of this facility, the Department has ceased discharges of contaminated waste water to the soil for the first time in more than 40 years. *Hanford Site, Washington. December 19, 1993.*

President Dwight D. Eisenhower warned that "the problem in defense is how far you can go without destroying from within what you are trying to defend from without." Meant as a warning against creating an all-powerful military-industrial complex, Eisenhower's statement is equally applicable to the environmental legacy of the Cold War.

Reconciling Democratic Involvement with Institutional Efficiency

Over the years, the Department's culture of secrecy and its history of contamination problems at nuclear weapons sites have profoundly affected both public attitudes and public opinion. Its credibility was among the lowest of any public institution. Ironically, many citizens who were previously shut out are now deluged with information and invitations to public meetings.

It will take more than meetings and paper to undo decades of mistrust. Only when the government and its contractors have earned again the trust of the public, the regulators, Native American Tribes, State and local governments, and public-interest groups, can there be meaningful progress. Involving outsiders in the Department's decision-making processes is only the first step along the path to trust. Ultimately, it will be actions that will define the Department. Every building and every waste site that is cleaned up will be another step forward. Trust will have to be built one relationship at a time, and it will take years to grow.

The Long-Term Vision for Environmental Management

Looking to the future of the Department's responsibilities in environmental management involves continually asking questions about the nature of the challenges to be faced and the ways of meeting them. The challenges can be met only with determined commitment over time. It is therefore imperative to think of strategic long-term goals. These goals cannot be established until questions like the following have been answered:

- How much environmental remediation does the nation want to "buy"?
- What are the savings from preventing future harm?
- What will the sites look like when the cleanup is complete?
- How do we control future land use?
- What is our obligation to future generations and to other species?

When these questions have been answered, environmental management programs can proceed with clear parameters and long-term goals.

What Might Future Generations Question?

Once removed from the fears and passions of the Cold War, many may find it easy to judge the actions of a generation now receding into history. Cooler minds today can, without great difficulty, conclude that many environmental problems could have been avoided through better housekeeping and waste management. But hindsight is not a useful lens through which to view our predecessors. The priority placed on weapons production over environmental protection was dictated by the imperatives of the time, just as the priorities of today are dictated by contemporary imperatives.

A question that haunts many who are involved in the Department's environmental management program is: "What are we doing today that will prompt another generation to say, 'how could those people – scientists, policymakers, and environmental specialists – not have seen the consequences of their actions?'" The question may be directed at current decisions about waste-disposal practices, or cleanup standards, or worker protection, or openness. No one can yet know what these future questions will be, much less the correct answers. Nonetheless, part of the inheritance of the people working on this new enterprise is a desire to look to the future and anticipate those questions.

Industrial safety sign at the Plutonium Finishing Plant. Signs like these help remind workers and managers to exercise sound safety procedures and keep them aware of the potential hazards associated with much of the work they do. *Hanford Site, Washington. July 11, 1994.*

If the intellectual giants of the Manhattan Project could not forsee all of the implications of their actions, it is particularly daunting for those involved in this new undertaking to consider what they might be missing in taking on the equally challenging task of cleaning up after the Cold War.

Closing the Circle on the Splitting of the Atom

The Department is building on a proud but troubled legacy – world-class scientific talent and a variety of environmental, safety and national security challenges inherited from the Cold War. To truly solve the problems left by the Cold War, the nation as a whole must commit itself to a sustained effort that will last for decades. Moreover, all of the people involved must look at the long-term consequences of current decisions in a way that, until now, has only rarely been done. Only then will future generations recognize this exciting but uncertain time as the beginning of the closing of the circle on the splitting of the atom.

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